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DISRUPTIONS IN FINANCIAL MARKETS: THE CASE OF ETFS IN THE COVID-19 CRISIS.

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ABSTRACT

ETFs have become one of the most prominent innovations of the last decades. Increasing interest among fixed-income ETFs generated concerns about their structural fragility, especially during periods of market stress. The covid-19 pandemic provides a unique laboratory to evaluate its resiliency. The analysis using daily data on fund performance and monthly observations on fund flow showed a significant drop in returns during the pandemic outbreak and outflows among ETFs with illiquid underlings, reporting differences across fund geographies. The regression results revealed evidence of the two unprecedented Federal Reserve interventions' vital role in calming markets, boosting ETFs returns, and attracting flows.

Keywords: ETFs, Covid-19, Fixed-Income, Flows, Performance, Resilience

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1. INTRODUCTION

Exchange-Traded Funds (ETFs) are among the most prominent and fastest-growing financial product innovations of the past two decades. ETFs are a cost-efficient and convenient tool to buy in a market index, a particular region, commodity, or any investment theme without owning all the constitutes. An ETF investor buys a unit of a fund that trades like equity on a secondary market, and like any other listed security, its shares are traded continuously at market prices. Also, ETFs allow investors to diversify their portfolios in a tax-efficient way. Besides, fixed-income ETFs bring liquidity to the inherently illiquid bond market.

Despite the clear benefits to investors, ETFs may pose additional market risks. One of the main risks comes from ETFs' heavy trading that adds co-movement and volatility in the underlying securities (Turner and Sushiko 2018). The associated risk may become especially problematic during times of market stress when ETF shares tend to be less liquid (Marco, Serrano, and Zechner 2019). This concern is fundamental for bond ETFs because they are composed of illiquid underlying securities that trade over the counter.

ETFs were developed in the 1990s and have gained immense popularity among investors. In August 2020, the assets under management (AUM) of ETFs reached $7 trillion for the first time (Financial Times 2020). In October 2020, the AUM of bond ETFs solely surpassed $1.4 trillion, making them one of the fastest-growing asset management categories (iShares 2020).

Market disruption occurs when markets stop functioning regularly, often leading to large and rapid market declines. Disruptions occur due to prevalent investors' fear that a specific factor will cease businesses' normal functioning. Regulation and institutional changes, new technologies, or evolving demands are some of the main reasons that initiate crashes leading to market disruptions. The financial crisis of 2008 and the rapid growth of the AUM of investment funds led to assorted regulation development. However, those changes did not impose

substantial market stress, and practitioners could not assess ETFs' resiliency, leading to an intensification of the speculations about their fragility.

The recent events that emerged due to the covid-19 crisis give an unprecedented opportunity to assess the implication of the ETF's growth during turbulent times. On January 9, 2020, the World Health Organization (WHO) confirmed the first coronavirus-related case in Wuhan, China. In just a matter of two weeks, the Centers for Disease Control and Prevention (CDC) announced the first coronavirus case in the US, and soon, the virus became a global concern. In February 2020, travel restrictions were imposed, refraining tourism and breaking major supply chains. Economies were on a halt disrupting the regular functioning of businesses. On March 13, WHO declared covid-19 as a pandemic, and two days later, Donald Trump announced a national emergency, unlocking billions of dollars in federal support to fight the disease. Financial markets were fast to react and took a big hit.

Recent studies already show evidence of the financial market stress during this period. In particular, Kargar, Lester, Lindsay, Liu, Weill, and Zúñiga (2020) documented that liquidity conditions for corporate bonds substantially deteriorated at the height of the crisis, and the Fed's announcements of interventions coincided with improvements in trading conditions in the bond market. Also, Haddad, Moreira, and Muir (2020) shared similar findings. They showed that bond ETFs traded at large discounts, especially on the safer end of the spectrum and that Fed's announcement to buy investment-grade debt pushed up prices and lowered bonds spread. Multiples press reports from ETF providers revealed that bond ETFs were resilient and more reliable for price discovery than the underlying bonds despite the turbulent times. Also, regardless of the speculation that Authorized Participants might step away in periods of market stress, ETFs functioned properly amidst the spiking volumes and high volatility (e.g., Blackrock 2020).

This study aims to provide systematic empirical analysis to assess the impact of the market stress caused by the covid-19 crisis and unprecedented Federal Reserve direct support and their implications for ETFs. The research complements the current literature by emphasizing ETFs and provides additional insights for different fund types. The main focus is on bond ETFs as they are an ideal laboratory to evaluate this task since their underlying indexes base on illiquid assets trading in OTC markets. Also, the additional data span covering the time period up to September 2020 allows for assessing the effects from a longer perspective than the existing studies.

First, I document the magnitude and timing of the crisis on ETFs. Graphical analysis and summary statistics acutely show that March was the month represented by numerous events that led to market disruptions. The VIX index reached its new record high. Until the Fed's intervention, equity and bond ETFs' returns were under severe pressure, reducing the dollar amount of assets under management across funds substantially.

Second, I inspect the impact on ETFs depending on the development of the covid-19 crisis, considering the buildup phase as of February 2020, the outbreak phase as the period until March 13, and the peak phase until April. The returns were mostly harmed in the outbreak phase, suggesting that investors only accounted for the slowdown until reasonably late in the crisis. I also incorporate information about Federal Reserve intervention by considering the following periods: the crisis phase from February 2020 till March 23, the first response period until April 9, and the second response period until May. The findings show that returns increased more after the first announcement of the Fed's intervention than after the second announcement, although the dollar amount of the support was higher for the second response. It could be possibly explained by the novelty of those unexpected actions that gave extra confidence to investors.

Regarding the timing of the events on flows, I consider a bit less granular split of subperiods due to the data's generality, referring to the buildup phase for February and the peak phase for March. The analysis revealed that the funds with more illiquid underlying assets tended to experience lower flows and showed that foreign ETFs' flows survived relatively well during the build phase suggesting that the investors first started to pull out money from the US-focused funds. Furthermore, I document that the Federal reserve interventions gave a significant boost for the markets and flows, not only to the directly affected investment-grade ETFs but also funds across all the asset classes.

During this crisis, ETFs proved their resiliency aside from the numerous speculations. However, the unique Federal Reserve intervention cannot be expected as a common practice in the future. Thus, it is not straightforward that ETFs would perform equally well without support.

The rest of the paper is organized as follows. Section 2 describes the used resources and introduces the data. Section 3 motivates the analysis and forms hypotheses. Section 4 shows the main findings of ETF's resiliency and performance in the covid-19 crisis documenting differences across fund types. Section 5 describes the limitations and gives recommendations for future studies. Section 6 discusses the findings of the analysis and concludes the research paper.

2. DATA

This section describes the procedure of sample construction and introduces the data. Definitions of all critical variables are in Appendix A. All the tables and figures illustrating the data are in Appendix B.

Fund characteristics, flows, and performance

The primary data source is quarterly fund characteristics, daily time-series of returns and net

asset value (NAV), and monthly time-series of returns, NAV, and total net asset value (TNA). I retrieved the data from the CRSP Mutual Funds database through the Wharton Research Data Services (WRDS) platform, first for fund characteristics data by filtering on the search query for the ETF universe (et_flag = F, where F = ETF) and choosing the dates between January 2015 and September 2020. The outcome is sample data for 2,747 unique ETFs, resulting in 33,363 quarterly fund observations. The sample consists of 2,213 equity and 534 bond funds allowing a comparison of investors' behavior across different fund types that follow previous literature (e.g., Jiang and Zheng 2015). Then, I created a list with unique fund identifiers and retrieved two databases with fund data on daily returns and monthly returns, TNA and NAV between 2015 and September 2020 for 2,451 distinctive funds, giving 2,564,492 daily 123,255 monthly fund observations. I supplement the data with VIX closing prices as a proxy for volatility retrieved from Yahoo Finance between 2015 and September 2020, resulting in 1,446 daily observations.

The primary response variables are ETF flows and performance. Following prior literature on mutual funds (e.g., Chevalier and Ellison 1997), I compute the net cash flow from the total net assets between two consecutive periods and the interim fund return. I estimate fund flows as net cash flow percentage growth; in particular, for fund *k* in month *t* flow is defined in the following way:

$$Flows_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1 + R_{i,t})}{TNA_{i,t-1}}$$

where, $TNA_{i,t}$ is the total net asset value of fund *i* at the end of month *t* and $R_{i,t}$ is the return of fund *i* during month *t.* The daily fund returns measure fund performance. I calculate returns as a change in NAV net of management expenses and 12-b fees, including reinvested dividends, as follows:

$$Returns_{i,t} = \left[\frac{NAV_{i,t} * cumfact}{NAV_{i,t-1}}\right] - 1$$

where, $NAV_{i,t}$ is the net asset value of fund *i* at the end of day *t*, $NAV_{i,t-1}$ is the net asset value of fund *i* up to three periods before *t,* and $cumfact$ is a total adjustment factor for each day the fund trades and each dividend.

Summary Statistics

Table 1 summarizes the main descriptive statistics (mean and standard deviation) of the dependable variables and key regressors, split by the full sample (Panel A) and a restrained sample covering dates from 2019 to 2020 (Panel B). Over the full sample period, ETFs recorded average monthly returns of 0.42% and flows of 5.05%, while during the restrained sample, returns of 0.82% and flows of 2.1%. On average, a fund held $1.8 billion and $2 billion net assets during the full and restrained period, respectively. On average, over the full sample period, ETFs had an expense ratio of 0.49%, turnover ratio of 63.6%, and a quarterly yield of 0.49%, while during the restrained period, 0.46%, 66.25%, and 0.49%, respectively. An average fund family has approximately 150 ETF funds.

ETF Fund Types

The CRSP database has its codes for each ETF consisting of up to four characters that identify fund characteristics and allowing to group funds by their types. Every consecutive character has an increasing granularity. Based on The CRSP Style Code guide, I grouped the funds based on the CRSP Levels 1, 2, and 4, focusing on geographies. Table 2 summarizes the results and shows ETFs' evolution by types from January 2015 to September 2020. In September 2020, there were 1,534 equity ETFs, out of which 1,019 focused on the US, 87 on Emerging Market, 62 on the EU region, and 32 on China, among others. Within the sample, the number of fixed income ETFs grew by over 60% during the last five years, reaching 394 in September 2020.

Within fixed-income ETFs, corporate funds have developed the most, almost quadrupling the number of funds over the last five years.

3. MOTIVATION AND HYPOTHESES

Equity markets were under severe stress in March 2020. As shown in Figure 1, VIX, the so-called fear index, reached its record high of 82.69 on March 16, surpassing the peak level from the last financial crisis in October 2008. As economies were shutting down, the demand for petrol collapsed, and on April 20, the price of WTI crude oil slumped into negative territory for the first time in history and traded at -$37.63 per barrel. Neither the corporate bond market was left untouched. Measured by BofA US Corporate Index Option-Adjusted Spread and BofA US High-Yield Index Option-Adjusted Spread indexes, spreads of investment-grade and high-yield bonds widened sharply in early March. They reached the peak on March 23, of 401 and 1,087 bps, respectively. Even though the spreads almost quadrupled for investment-grade bonds and nearly tripled for high-yield bonds compared to the pre-pandemic levels, they did not reach the 2008 financial crisis levels. Also, as reported widely (e.g., BlackRock 2020 or Haddad, Moreira and Muir 2020), during the height of volatility, bond ETFs had large price discounts to their corresponding NAVs, including ETFs that have a matched mutual fund.

On March 23, as there was no doubt about hardship worldwide triggered by the covid-19 crisis, Federal Reserve announced unprecedented direct measures to support the US economy during those challenging times to calm the markets. The Fed established two facilities, the Primary Market Corporate Credit Facility (PMCCF) and the Secondary Market Corporate Credit Facility (SMCCF), with the purpose of direct purchasing of investment-grade bonds in the primary and secondary markets in order to provide the much-needed liquidity. The Fed took both sides of the market, ensuring investors can raise cash whenever they want. The US central bank accomplished it by trading ETFs, as it would be more troublesome to buy individual bonds

than stocks. After the substantial public support, spreads stabilized. On April 9, Federal Reserve announced extensions to the previously mentioned plan to increase the capacity to $850 billion (from less than $300 billion) and include high-yield bonds if they were investment-grade rated on March 22.

All those events led to the formulation of the following three main hypotheses of the study. First, I hypothesize that the crisis's intensity is negatively correlated with investors' confidence and fund performance; thus, ETFs will experience worse returns as the covid-19 evolves. Second, I hypothesize that investors worried about the potential structural fragility during times of market stress will opt-out from investments in the ETFs with illiquid underlying assets; thus, those funds will be more prone to outflows than funds with liquid underlying assets during the covid-19 crisis. Third, I hypothesize that funds directly affected by the policy measures will benefit more than the rest; thus, the Federal Reserve interventions will boost the returns and flows of investment-grade ETFs the most.

4. ASSESSMENT OF ETF RESILIENCY

This section sizes up fund resiliency to the covid-19 crisis using daily and monthly time-series data on ETFs. March 2020 was a striking month for markets represented by strong negative returns and shrinking values of assets under management of ETFs across all asset classes, and negative flows across bond ETFs. The disruptions were not sustained for long, as the Fed interventions effectively relieved the funds' stress.

Graphical Analysis

Table 2 reveals that during the last five years, the number of ETFs available in the market increased year over year, but during the first quarter of 2020, there were more funds liquidated than created. Liquidations of equity funds mainly led it while the offering of bond ETFs has

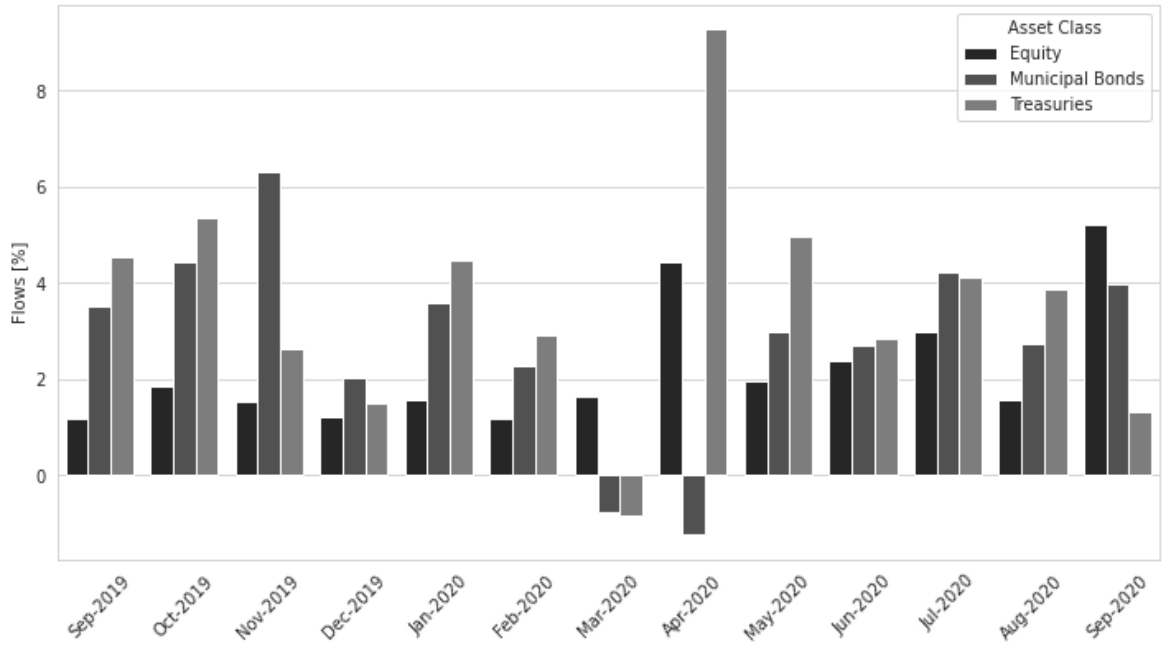

Figure 3. Average Flows for ETFs by Asset Class

This figure plots a monthly evolution of average flows for ETFs of three asset classes: Equity, Municipal Bonds, and Treasury. The time period is September 2019 to September 2020. It is a proprietary elaboration based on the estimation of flows from the monthly Total Net Asset Value, returns data, and fund characteristics data from the CRSP Fund Mutual database. Flow averages do not include funds that were created after Q3 2018.

broadened. Nevertheless, those liquidations had not much to do with the increased volatility in the market, but with the acquisitions of ETF families of OppenheimerFunds and Guggenheim Partners by Invesco, one of the biggest fund providers, which created redundant funds.

As shown in Figure 2, in March 2020, treasury and municipal bond ETFs experienced severe aggregated net cash outflows, and investors pulled out in total $19.5 billion and $2.4 billion, respectively. Nevertheless, treasury ETFs' negative trend did not last long as already in April, the outflows were neutralized by a net cash inflow of $19.8 billion. Regarding monthly flows, as Figure 3 demonstrates, the month of March 2020 stands out again. An average bond ETF had negative flows, while during the consecutive month, treasury ETFs already picked-up. Municipal bond ETFs had positive flows only starting in May. This figure also shows that, on average, equity ETFs sustained positive flows throughout the whole period of interest and

Figure 4. Weighted Cumulative Returns for ETFs by Asset Class

This figure plots a daily time-series of weighted cumulative returns for ETFs of three asset classes: Equity, Municipal Bonds, and Treasury. The time period is September 2019 to September 2020. It is a proprietary elaboration based on the daily returns and fund characteristics data from the CRSP Fund Mutual database. The cumulative returns are calculated since September 2019. For simplicity, the weights were calculated using the Total Net Asset Value of each fund at the end of Q3 2019.

had experienced higher average flows in the months following the Fed intervention than during pre-pandemic times.

Figure 4 demonstrates that cumulative returns started to deteriorate as the pandemic evolved, and a first sharp drop in returns occurred for equity ETFs in mid-February 2020. Bond ETFs experienced the adverse trend a bit later, starting at the beginning of March and reaching their lowest point just before the first direct Federal Reserve intervention of March 23. The returns of equity ETFs suffered more than bond ETFs as their weighted cumulative return surpassed -26% since September 2020, compared to treasury ETFs which nearly reached -5% over the same period. After March 23, ETFs' returns across all asset classes hiked, and around May, they reached their pre-pandemic levels. In the following months, ETFs experienced a rally and reached their highest point throughout the interest period at the turn of August and September.

Figure 5 that plots a time-series of the average net asset value of ETFs by asset class, shows similar findings as to the cumulative returns. An average equity ETF reached the pre-pandemic highest NAV on February 2, 2020, of $54.73 while treasury ETF on March 6 of $49.83 and reached their minimums of $36.13 on March 23 and $45.02 on March 13, respectively. Thus, equity ETFs' value took a more prominent and more prolonged hit than the treasury ETFs.

Figure 6 represents a time-series of average ETFs assets under management and also shows similar dynamics to cumulative returns. On average, the AUM of equity ETFs started to decrease in February and reached its low in March, while for treasury ETFs the decrease occurred only in March. For municipal bond ETFs, the drop started in March and sustained over April. In May, the average AUM picked up again, and by the end of August, the total AUM of ETFs overpassed the pre-pandemic levels. When looking at the top movers in terms of AUM during the first quarter of 2020, high-yield funds were the top losers for both treasury and municipal bond ETF funds (Figure 7 and 8). Across equity ETFs (Figure 9), energy and financial services ETFs were among the top losers in Q1 2020 and lost more than half of AUM during that quarter. Those shocks portray the magnitude of the hit that these industries had taken during the covid-19 crisis.

Regression Analysis

Additionally to the graphical analysis, I take a more formal approach to assess ETFs' resiliency under the shock caused by the covid-19 crisis by performing regression analysis on the restrained sample covering the period from January 2019 to September 2020. ETFs created after the third quarter of 2018 are excluded from the sample to reduce the noise coming from newly created funds. I use a linear model with fixed effects for a month to eliminate omitted variable bias caused by excluding unobserved variables that evolve over time but are constant

across funds. Also, the regressions include controls for fund characteristics, covering the fund's NAV, expense ratio, turnover ratio, family count, and as well as lagged periods returns. To assess the impact of the crisis's evolution and the Fed intervention, I create dummies for different periods following standard categorization across the literature (e.g., Falato, Goldstein and Hortaçsu 2020). Also, I create additional dummy variables for different fund types and geographical focus.

Firstly, I ran regressions on the monthly flow data. The following equation represents the principal regression:

$$\begin{aligned} Flows_{i,t} = {} & \beta_1 \times Returns_{i,t} + \beta_2 \times Crisis + \beta_3 \times Response + \beta_4 \times Equity + \beta_5 \times Bond \\ & + \beta_6 \times Foreign\ Equity + \beta_7 \times Foreign\ Bond + \beta_8 \times Investment\ Grade \\ & + \beta_9 \times High\ Yield + \beta_{10} \times X_{i,t} + \beta_{11} \times \varepsilon_{i,t} \end{aligned} \quad (1)$$

where, the dependent variable, $Flows_{i,t}$, is a monthly flow for fund i in period t, and the independent variable, $Returns_{i,t}$, is the total monthly return for fund i in period t. The main variables of interest, Crisis dummy variable for February and March, and the Response dummy for April and May, the period following the first Federal Reserve intervention. Equity and Bond are dummies that equal one for an equity ETF and bond ETF, respectively. Foreign Equity and Foreign Bond are dummies that equal one for equity and bond ETFs that are not US-focused, respectively. There are two dummies within bond ETFs, High Yield that equals one for high-yield ETFs, and Investment Grade for investment-grade ETFs. $X_{i,t}$ is a vector of controls for the fund characteristics and lagged returns. The idiosyncratic error term is denoted as $\varepsilon_{i,t}$. I complement this regression by including interactions between the indicators for the covid-19 crisis and the Federal Reserve response and different fund types. Complete regression result summaries are in Table 3.

Then, I repeat the process by exchanging two dummies, Crisis, and Response for indicators of the pandemic's evolution. The equation is as the following:

$$Flows_{i,t} = \beta_1 \times Returns_{i,t} + \beta_2 \times Buildup + \beta_3 \times Peak + \beta_4 \times Equity + \beta_5 \times Bond + \beta_6 \times Foreign\ Equity + \beta_7 \times Foreign\ Bond + \beta_8 \times Investment\ Grade + \beta_9 \times High\ Yield + \beta_{10} \times X_{i,t} + \beta_{11} \times \varepsilon_{i,t} \quad (2)$$

where, the dependent variable, $Flows_{i,t}$, is a monthly flow for fund i in period t, the main variables of interest, Buildup, and Peak dummies, are subperiods of the covid-19 crisis. Buildup is an indicator for February 2020, and Peak for March 2020. The other variables have the same interpretation as in equation (1). I ran an additional regression using the same variables but adding interactions between the indicators for the evolution of the covid-19 crisis and the different types of funds to assess marginal effects. Complete regression result summaries are in Table 4.

Secondly, I ran an analogical set of regressions but on returns instead of flows and using daily observations. The data's additional granularity allows further split between specific fed announcements and decomposition of the covid-19 crisis evolution indicators. The baseline equation is as the following:

$$Returns_{i,t} = \beta_1 \times Crisis + \beta_2 \times First\ Response + \beta_3 \times Second\ Response + \beta_4 \times Equity + \beta_5 \times Bond + \beta_6 \times Foreign\ Equity + \beta_7 \times Foreign\ Bond + \beta_8 \times Investment\ Grade + \beta_9 \times High\ Yield + \beta_{10} \times X_{i,t} + \beta_{11} \times \varepsilon_{i,t} \quad (3)$$

where, the dependable variable, $Returns_{i,t}$, is the total daily return for fund i in period t, including the reinvested dividends and net of management expenses and 12-b fees. Crisis is a dummy for February until March 23, 2020, the first Federal Reserve announcement of the direct intervention. First Response is an indicator for the period between March 23 and the second Federal Reserve announcement on April 9, while Second Response is from April 9 until May

2020. The other variables have the same interpretation as in equation (1). Also, I compliment this regression with another one by including interactions between indicators for the covid-19 crisis, federal reserve responses, and different fund types. Complete regression result summaries are in Table 5.

Then, I repeat the process as in the regressions on flows, but with decomposed Peak variable for Outbreak and Peak. The equation is the following:

$$Returns_{i,t} = \beta_1 \times Buildup + \beta_2 \times Outbreak + \beta_3 \times Peak + \beta_4 \times Equity + \beta_5 \times Bond + \beta_6 \times Foreign\ Equity + \beta_7 \times Foreign\ Bond + \beta_8 \times Investment\ Grade + \beta_9 \times High\ Yield + \beta_{10} \times X_{i,t} + \beta_{11} \times \varepsilon_{i,t} \quad (4)$$

where, the dependable variable, $Returns_{i,t}$, is the total daily return for fund i in period t, including reinvested dividends and net of management expenses and 12-b fees. The specific subperiods of the evolution of the covid-19 crisis are the following: Buildup dummy for February 2020, Outbreak for March 1, 2020, to March 13, 2020, that is, the day when WHO announced pandemic, and Peak for March 13, 2020, to April 2020. The other variables have the same interpretation as in equation (1). Also, I compliment this regression with another one by including interactions between indicators for subperiods of the covid-19 crisis and different fund types. Complete regression result summaries are in Table 6.

The impact on flows

Table 3 presents the estimation of the impact of the covid-19 crisis and the Fed's response on fund flows. In line with visual evidence, the coefficient on Crisis for fund flows, in the regression without interactions is negative. Also, the marginal effect of the crisis on both equity and bond ETFs is negative, with a more noticeable impact on bonds consistent with graphical representations. Nevertheless, those results are not statistically significant, thus only suggesting

Table 3. Impact of Crisis and Fed Response on Fund Flows

This table reports the main results of an analysis of monthly flows regressed on indicator variables for the covid-19 crisis and the Federal Reserve response, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). Both regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns, and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. ***, **, and * denote significance at 1%, 5% and 10% level, respectively. All variables descriptions are in Appendix A. Complete regression results are in Appendix B.

	Flows	
	Without interaction	With interaction
	(1)	(2)
Crisis (Feb-Mar, 2020)	-0.010 (0.007)	0.009 (0.021)
Response (Apr-May, 2020)	0.026* (0.014)	0.178** (0.072)
Equity*Crisis		-0.007 (0.021)
Equity*Response		-0.137* (0.074)
Bond*Crisis		-0.022 (0.031)
Bond*Response		-0.144 (0.094)
Foreign Equity*Crisis		-0.022* (0.012)
Foreign Equity*Response		-0.068** (0.031)
Foreign Bond*Crisis		-0.027 (0.028)
Foreign Bond*Response		-0.024 (0.075)
Investment Grade*Crisis		0.023 (0.044)
Investment Grade*Response		0.003 (0.108)
High Yield*Crisis		-0.010 (0.035)
High Yield*Response		-0.029 (0.099)
Month FE	Yes	Yes
Observations	27,968	27,968
R^2	0.001	0.002

that there was a trend that an average ETF experienced outflows due to the covid-19 crisis and that the effect was more substantial for funds with more illiquid underlying assets. During the crisis, both equity and bond ETFs with non-US focus had suffered more in terms of flows than the funds with US focus as the coefficients on interaction terms between Crisis and Foreign Bond and Foreign Equity are negative. However, the results are statistically significant only for equity funds. Monthly flows of foreign equity ETFs, on average, decreased by 2.2% compared to the ETFs with US-focus during the crisis period. The flows of investment-grade ETFs tended to endure relatively well during the crisis, as the interaction term's coefficient between Investment Grade and Crisis is positive. Simultaneously, on the riskier end of the spectrum of

Table 4. Impact of the Evolution of Crisis on Fund Flows

This table reports the results of an analysis of monthly flows regressed on indicator variables for different stages of the covid-19 crisis, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). Both regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns, and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. ***, **, and * denote significance at 1%, 5% and 10% level, respectively. Complete regression results are in Appendix B.

	Flows	
	Without interaction	With interaction
	(1)	(2)
Buildup (Feb, 2020)	-0.015 (0.010)	0.049* (0.028)
Peak (Mar, 2020)	-0.005 (0.010)	-0.035 (0.028)
Equity*Buildup		-0.077*** (0.029)
Equity*Peak		0.065** (0.029)
Bond* Buildup		-0.060 (0.042)
Bond*Peak		0.019 (0.043)
Foreign Equity*Buildup		0.023 (0.017)
Foreign Equity*Peak		-0.064*** (0.017)
Foreign Bond*Buildup		-0.012 (0.039)
Foreign Bond*Peak		-0.042 (0.039)
Investment Grade* Buildup		0.009 (0.060)
Investment Grade*Peak		0.037 (0.061)
High Yield* Buildup		-0.024 (0.048)
High Yield*Peak		0.006 (0.049)
Month FE	Yes	Yes
Observations	27,968	27,968
R^2	0.001	0.003

fixed income, high-yield ETFs had a tendency to be affected to a greater extent compared to other types of bond ETFs.

In line with the Fed's intentions to boost the market, the positive and statistically significant coefficient on Response shows signs of the policy measures' effectiveness. The coefficient implies that monthly fund flows increased by 2.6% during the Federal Response period, which is more than the average monthly fund flows over the restrained period. When looking directly into the specific types of funds that the Fed addressed, the regressions do not show that investment-grade ETFs were the ones that benefited more from the public support even though they were the ones addressed by the facilities.

Table 4 presents the estimation of the impact of different stages of the evolution of the covid-19 crisis on fund flows. The regression without interaction shows that, in general, during the buildup and peak phase, ETF flows suffered as both coefficients are negative, but the results are not statistically significant. When looking into more details at the regression with interactions and evaluating the evolution of the crisis, the buildup phase harmed bond and equity ETFs flows as the coefficients of the interaction terms on Bond and Buildup, and Equity and Buildup are negative. Also, the effect is slightly more substantial for equity ETFs. The overall effect on the peak phase for bond ETFs was even more notable than during the buildup phase, but the results are not statistically significant, suggesting only a trend. On the other hand, the peak phase had an overall positive effect on equity flows. It is in line with the graphical analysis findings for equity ETFs flows, which revealed that this fund type had positive average flows during the covid-19 crisis and picked up the momentum in the peak phase. The positive and statistically significant coefficient on the interaction of Peak and Equity additionally validates those findings.

Focusing on foreign ETFs, for both equity and bond, there is a trend that flows stood up well in the buildup phase, and investors started to pull out money only in the peak phase. However, the evidence is statistically significant only for foreign equity ETFs in the peak phase. It suggests that investors first pulled out money from the US-focused ETFs and then from the foreign-focused ones.

Impact on returns

Table 5 presents the estimation of the impact of the covid-19 crisis and the Fed's responses on fund returns. In line with visual evidence, in the regression without interactions, the coefficient on Crisis is negative and highly statistically significant, providing an additional indication that the pandemic had disrupted funds' performance. The coefficient implies that the daily returns

Table 5. Impact of Crisis and Fed Response on Fund Returns

This table reports the results of an analysis of daily returns regressed on indicator variables for the covid-19 crisis and indicators for two Federal Reserve response, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). All the regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. ***, **, and * denote significance at 1%, 5% and 10% level, respectively. All variables are described in Appendix A. Complete regression results are in Appendix B.

	Returns	
	Without interaction	With interaction
	(1)	(2)
Crisis (Feb-Mar 23, 2020)	-0.011*** (0.0001)	-0.010*** (0.0003)
First Response (Mar 23-Apr 9, 2020)	0.013*** (0.0001)	0.011*** (0.0005)
Second Response (Apr 9-May, 2020)	0.004*** (0.0001)	0.004*** (0.0003)
Equity*Crisis		-0.002*** (0.0003)
Equity*First Response		0.004*** (0.001)
Equity*Second Response		0.0001 (0.0003)
Bond*Crisis		0.007*** (0.0005)
Bond*First Response		-0.006*** (0.001)
Bond*Second Response		-0.002*** (0.0005)
Foreign Equity*Crisis		-0.0005** (0.0002)
Foreign Equity*First Response		-0.003*** (0.0003)
Foreign Equity*Second Response		-0.0005** (0.0002)
Foreign Bond*Crisis		-0.002*** (0.0005)
Foreign Bond*First Response		0.001** (0.001)
Foreign Bond*Second Response		0.001 (0.0005)
Investment Grade*Crisis		0.002*** (0.001)
Investment Grade*First Response		-0.003** (0.001)
Investment Grade*Second Response		-0.0003 (0.001)
High Yield*Crisis		-0.003*** (0.001)
High Yield*First Response		0.003*** (0.001)
High Yield*Second Response		0.0003 (0.001)
Month FE	Yes	Yes
Observations	835,541	835,541
R^2	0.079	0.081

for an average fund during the crisis period decreased by 1.1%, which is substantially more than the average of fund returns over the restrained period of 0.04%. The coefficients on the interaction terms of Bond and Crisis, and Equity and Crisis, imply that the marginal effect of the covid-19 crisis increased returns of bond ETFs by 0.7% and decreased returns of equity funds by 0.2% compared to other types of ETFs. Both marginal effects of Crisis on Foreign

Table 6. Impact of the Evolution of Crisis on Fund Returns

This table reports the results of an analysis of daily returns regressed on indicator variables for different stages of the Covid-19 crisis, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). All the regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns, and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. ***, **, and * denote significance at 1%, 5% and 10% level, respectively. All variables are described in Appendix A. Complete regression results are in Appendix B.

	Returns	
	Without interaction	With interaction
	(1)	(2)
Buildup (Feb, 2020)	-0.004*** (0.0001)	-0.004*** (0.0004)
Outbreak (Mar 1-13, 2020)	-0.011*** (0.0002)	-0.011*** (0.001)
Peak (Mar 13-Apr, 2020)	0.002*** (0.0001)	0.001*** (0.0003)
Equity*Buildup		-0.001*** (0.0004)
Equity*Outbreak		-0.001 (0.001)
Equity*Peak		0.001* (0.0003)
Bond* Buildup		0.004*** (0.001)
Bond*Outbreak		0.010*** (0.001)
Bond*Peak		-0.002*** (0.001)
Foreign Equity*Buildup		-0.00001 (0.0003)
Foreign Equity*Outbreak		-0.004*** (0.0004)
Foreign Equity*Peak		-0.0003 (0.0002)
Foreign Bond*Buildup		-0.001* (0.001)
Foreign Bond*Outbreak		-0.002*** (0.001)
Foreign Bond*Peak		0.0001 (0.0005)
Investment Grade* Buildup		0.001 (0.001)
Investment Grade*Outbreak		0.003** (0.001)
Investment Grade*Peak		-0.0001 (0.001)
High Yield* Buildup		-0.001 (0.001)
High Yield*Outbreak		-0.004*** (0.001)
High Yield*Peak		-0.001 (0.001)
Month FE	Yes	Yes
Observations	835,541	835,541
R^2	0.061	0.062

Equity and Foreign Bonds are adverse and statistically significant, implying respective average daily fund returns decrease of 0.05% and 0.2% compared to US-focused funds.

Both Federal Reserve direct interventions, as intended, gave a boost to the performance of ETFs as the coefficient for the First Response and Second Response are positive and highly statistically significant. The coefficient on the First Response dummy implies that, on average, daily fund returns increased by 1.3%, while the coefficient on Second Response implies an

increase of 0.4% compared to an average of fund returns over the restrained period of 0.04%. Therefore, the first shock was firmer, even though the second support's dollar amount was more generous than the first support. Surprisingly, the first response had a more positive effect on high-yield ETFs' performance than on investment-grade ETFs, even though the intervention fully covered only investment-grade ETFs. Indeed, the coefficients imply that on average, between the first and the second response, daily returns of an investment-grade ETF decreased by 0.3% and of high-yield ETF increased by 0.3% compared to the other types of bond ETFs. The Second Response had a similar effect on both high-yield and investment-grade ETFs, but the results are not statistically significant.

Table 6 presents the estimation of the impact of different stages of evolution of the covid-19 crisis on fund returns. Throughout the pandemic, the returns started to suffer already in the buildup period and further intensified in the outbreak phase. Both coefficients on Buildup and Outbreak are negative and highly statistically significant. On average, daily fund returns decreased by 0.4% during the buildup period, while in the outbreak period by 1.1%, which is strongly inferior compared to the average daily return of 0.04% over the restrained period. It shows that the performance started to suffer only once the reports of confirmed cases intensified, and the outbreak of the pandemic was inevitable. Nevertheless, the coefficient on Peak is positive and implies that, on average, fund returns increased by 0.2% during the peak phase compared to the average return over the restrained period. During the outbreak phase, the effect was even more substantial in the case of foreign-focused ETFs. For both, equity and bond ETFs the coefficients are statistically significant.

Complementary to the findings from the graphical analysis, the regressions with interactions provide additional evidence that the performance of bond ETFs did not suffer a much as equity ETFs as the marginal effects of the buildup and outbreak phases are slightly positive, while the overall effect of those phases on bond ETFs is still negative and statistically

significant. For example, the coefficients on the interaction terms between Bond and Buildup, and Equity and Build, imply that, on average, during the buildup phase, daily returns of bond ETFs were higher by 0.4% while of equity ETF were lower by 0.1% compared to other ETF types. Throughout all the crisis phases, the bonds on the riskier end of the spectrum were suffering the most, while investment-grade ETFs returns prospered relatively well. For example, coefficients on the interaction terms of High Yield and Outbreak, and Investment Grade and Outbreak, imply that, during the outbreak phase, returns of an average high-yield ETF decreased by 0.4%, while investment-grade ETFs increased by 0.3% compared to the other bond ETF types.

5. LIMITATIONS

The first major drawback of the research is the generality of the total net assets data that limits the estimation of flows to monthly observations. The recent literature revealed that the market disruptions disappeared as fast as they appeared (e.g., Haddad, Moreira and Muir 2020). Thus, monthly data only allows showing the smoothed-out effects without capturing the short-sighted impact. Also, more observations might have improved the data's explanatory power and add additional statistical significance to the regressions.

Secondly, this study only allowed to assess the short-term impact (up to 6 months) of the crisis and unprecedented governmental intervention. Due to the novelty of these events, it was impossible to show the long-term effect on ETFs.

That is why I encourage researchers to perform a similar study in the future to include more granular data on flows and a longer time frame after the covid-19 crisis. It would allow to picture the impacts of specific events and assess the pandemic evolution's long-term effects and unprecedented governmental support.

6. DISCUSSION AND CONCLUSIONS

Working with data on fund flows, performance, and characteristics, and using the covid-19 crisis as the laboratory of the market stress, I evaluated different interdependencies depending on fund types. The visual evidence and results from regressions clearly showed that the markets tumbled when reports related to the covid-19 pandemic intensified. The returns of ETFs took a big hit, especially during the outbreak phase in early March 2020. The regression results' significance provides evidence that ETFs' performance suffered more as the pandemic intensified and bond ETFs were the least affected fund type. After the WHO declaration of the pandemic, the ETFs returns stood up relatively well, suggesting that investors already accounted for the impacts of the covid-19 crisis.

Despite many concerns among theoreticians and practitioners about ETFs' fragility, they proved their resiliency even during significant market stress. Although returns were suffering, there was high volatility and uncertainty in the market; investors put more money into equity ETFs during the pandemic. As expected, the regression results imply that there was a trend that funds with more illiquid underlying assets were more prone to negative flows compared to the funds with liquid underlying assets.

The unprecedented Federal Reserve interventions played a material role in providing liquidity for ETFs and significantly boosted the financial markets. Although, the regression results do not show evidence that funds directly affected by the Fed intervention were the ones that benefited the most. It could be explained that the extra boost occurred only just after the intervention, which cannot be explained by the regressions.

The Authorized Participants lived up to their responsibilities and provided liquidity, including bond ETFs, which underlying assets were very illiquid or even halted trading. Despite the challenging conditions, bond ETFs play an increasingly important role in markets as investors are putting billions into those funds this year. The increased interest in bond ETFs led

to the emergence of new funds built on bonds and mixed strategies comprised of bonds and equities.

Nevertheless, the public measures addressed to stabilize the market were unprecedented, and it is not expected that they become the new normal. That is why, when thinking about implications for those events, it cannot be confirmed that the structural fragilities of ETFs are fully resilient to those stress tests.

Undoubtedly, ETFs are one of the most prominent financial innovations of the last decades. They have attracted investors from all around the world, providing an easy and cost-effective way to invest money across all main asset-classes and many subgroups spanning all geographies. Private and public investors appreciated ETFs' benefits as the Fed used them as an intermediary to accomplish their goal of boosting the market. The research showed evidence that markets were under severe stress during the covid-19 pandemic, where equity ETFs were more prone to more significant swings in returns. At the same time, there was a tendency that bond funds with illiquid underlying assets were more prone to outflows.

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APPENDIX A

The variables in this research paper are extracted from four central databases for January 2015 to September 2020 for ETF funds: daily net assets and returns from CRSP Mutual Fund Database, monthly total net assets and returns from the CRSP Mutual Fund database, quarterly fund characteristic from the CRSP Mutual Fund database, and daily VIX data from Yahoo Finance.

The variables are defined as follows:

Flows [%]. Is defined as: $Flows_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1+R_{i,t})}{TNA_{i,t-1}}$, where $TNA_{i,t}$ in total net assets in period t, $TNA_{i,t-1}$ is total net assets in the previous period, $R_{i,t}$ is the return over the period t.

Returns [%]. Is the total return per share defined as: $Returns_{i,t} = \left[\frac{NAV_{i,t} * cumfact}{NAV_{i,t-1}}\right] - 1$, where $NAV_{i,t}$ is the net asset value of fund *i* at the end of day *t*, $NAV_{i,t-1}$ is the net asset value of fund *i* up to three periods before *t,* and $cumfact$ is a total adjustment factor for each day the fund trades and each dividend.

Net cash flow [$]. Is defined as: $NCF_{i,t} = TNA_{i,t} - TNA_{i,t-1}(1 + R_{i,t})$, where $TNA_{i,t}$ in total net assets in period t, $TNA_{i,t-1}$ is total net assets in the previous period, $R_{i,t}$ is the return over the period t.

Net Asset Value [$]. Is the value of fund's underlying assets minus its liabilities divided by the number of shares outstanding.

Expense Ratio. Is the ratio of fund's operating expenses to total investment of shareholders.

Turnover Ratio. Minimum of aggregated sales or aggregated purchases of securities divided by the average 12-month total net assets of a fund**.**

Yield. Is income yield defined as the ratio of income distributions and NAV.

Family Count. Is the total number of funds that belong to the fund provider family.

VIX. Is the daily observation of the closing price of the CBOE VIX Volatility Index.

APPENDIX B

Tables

Table 1. Summary Statistics

This table describes statistics (mean and standard deviation) for the critical variables over the full sample (Panel A) and restrained sample (Panel B). It is a proprietary elaboration based on the data from the CRSP Fund Mutual database. Flows averages do not include funds that were created after the third quarter of 2018.

Panel A: Summary Statistics: Full Sample (2015-2020)		
	mean	std
Daily NAV [$]	45.740	35.805
Daily Returns [%]	0.023	1.864
Monthly NAV [$]	45.652	35.742
Monthly Returns [%]	0.415	7.642
Monthly Total Net Assets [mln $]	1765.006	8941.019
Flows [%]*	5.051	196.046
Quarterly Yield [%]	0.485	0.513
Expense Fee [%]	0.485	0.289
Turnover Ratio [%]	63.601	184.811
Family Count	151.716	134.155
VIX	17.125	8.204
Panel B: Summary Statistics: Restrained Sample (2019-2020)		
	mean	std
Daily NAV [$]	45.093	37.966
Daily Returns [%]	0.044	2.469
Monthly NAV [$]	45.196	38.113
Monthly Returns [%]	0.817	10.002
Monthly Total Net Assets [mln $]	1983.884	10277.742
Flows [%]*	2.095	28.212
Quarterly Yield [%]	0.493	0.487
Expense Ratio [%]	0.464	0.282
Turnover Ratio [%]	66.253	191.959
Family Count	150.586	136.261
VIX	21.846	11.899

Table 2. Distribution of Unique ETFs by Fund Category and Regional Focus

This table shows the distribution of ETF counts per fund category and their geographical focus from 2015 to 2020 yearly, and for 2020 quarterly. It is a proprietary elaboration based on the fund characteristics data from the CRSP Fund Mutual database.

CRSP Level 1	CRSP Level 2	CRSP Level 4	Dec-2015	Dec-2016	Dec-2017	Dec-2018	Dec-2019	Mar-2020	Jun-2020	Sep-2020
Equity	Domestic	US	714	794	881	956	1004	1006	1012	1019
	Foreign	China	26	26	32	36	34	32	31	32
		EM Emerging Markets	81	81	89	95	95	90	88	87
		EU European Region	69	71	76	75	71	70	68	62
		India	15	17	19	23	22	21	21	21
		Japan	22	20	20	21	22	22	21	18
		Latin America	16	16	17	18	18	18	18	17
		No regional focus	178	201	217	255	270	264	270	257
		Pacific Ex Japan	19	16	16	16	12	12	11	9
		Pacific In Japan	9	15	15	14	14	13	13	12
Subtotal			1149	1257	1382	1509	1562	1548	1553	1534
Fixed Income	Corporate	No regional focus	13	36	42	41	48	48	49	49
	Foreign	Foreign	27	30	32	43	47	43	43	43
	Government	US	40	42	45	46	46	56	58	59
	Muni	US	30	28	35	44	57	57	57	56
	Other	No regional focus	134	126	147	179	190	188	185	187
Subtotal			244	262	301	353	388	392	392	394
Mixed FI & Equity	Other	No regional focus	40	47	59	64	66	67	70	73
Other	Currency	No regional focus	17	16	12	12	11	11	10	10
	Mortgage-backed	US	13	14	14	14	16	16	16	16
	Other	No regional focus	25	40	32	39	88	96	105	120
Subtotal			55	70	60	67	115	123	131	146
Total			1488	1636	1800	1991	2131	2130	2146	2147

Table 3. Impact of Crisis and Fed Response on Fund Flows

This table reports the results of an analysis of monthly flows regressed on indicator variables for the covid-19 crisis and the Federal Reserve response, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). Both regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns, and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. All variables descriptions are in Appendix A.

	Flows	
	Without interaction	With interaction
	(1)	(2)
Monthly Returns	-0.106 (0.224)	-0.108 (0.224)
1-Period Lagged Returns	-0.196 (0.219)	-0.197 (0.219)
2-Period Lagged Returns	-0.293 (0.219)	-0.292 (0.219)
Monthly NAV	-0.010 (0.020)	-0.011 (0.020)
Family Count	-0.007 (0.005)	-0.007 (0.005)
Management Fee	0.046 (0.064)	0.049 (0.064)
Expense Ratio	-0.020 (0.016)	-0.020 (0.016)
Turnover Ratio	0.056 (0.046)	0.056 (0.046)
Crisis (Feb-Mar, 2020)	-0.010 (0.007)	0.009 (0.021)
Response (Apr-May, 2020)	0.026* (0.014)	0.178** (0.072)
Equity	-0.005 (0.007)	-0.002 (0.008)
Bond	0.003 (0.010)	0.007 (0.011)
Foreign Equity	-0.009** (0.004)	-0.005 (0.004)
Foreign Bond	0.002 (0.009)	0.005 (0.010)
Investment Grade	-0.009 (0.014)	-0.012 (0.015)
High Yield	0.008 (0.011)	0.010 (0.012)
Equity*Crisis		-0.007 (0.021)
Equity*Response		-0.137* (0.074)
Bond*Crisis		-0.022 (0.031)
Bond*Response		-0.144 (0.094)
Foreign Equity*Crisis		-0.022* (0.012)
Foreign Equity*Response		-0.068** (0.031)
Foreign Bond*Crisis		-0.027 (0.028)
Foreign Bond*Response		-0.024 (0.075)
Investment Grade*Crisis		0.023 (0.044)
Investment Grade*Response		0.003 (0.108)
High Yield*Crisis		-0.010 (0.035)
High Yield*Response		-0.029 (0.099)
Month FE	Yes	Yes
Observations	27,968	27,968
R^2	0.001	0.002
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 4. Impact of the Evolution of Crisis on Fund Flows

This table reports the results of an analysis of monthly flows regressed on indicator variables for different stages of the covid-19 crisis, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). Both regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns, and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. All variables descriptions are in Appendix A.

	Flows	
	Without interaction	With interaction
	(1)	(2)
Monthly Returns	-0.035 (0.226)	-0.035 (0.226)
1-Period Lagged Returns	-0.188 (0.219)	-0.185 (0.219)
2-Period Lagged Returns	-0.311 (0.223)	-0.308 (0.223)
Monthly NAV	-0.011 (0.020)	-0.011 (0.020)
Family Count	-0.007 (0.005)	-0.007 (0.005)
Management Fee	0.046 (0.064)	0.047 (0.064)
Expense Ratio	-0.020 (0.016)	-0.020 (0.016)
Turnover Ratio	0.056 (0.046)	0.057 (0.046)
Buildup (Feb, 2020)	-0.015 (0.010)	0.049* (0.028)
Peak (Mar, 2020)	-0.005 (0.010)	-0.035 (0.028)
Equity	-0.004 (0.007)	-0.003 (0.008)
Bond	0.003 (0.010)	0.006 (0.011)
Foreign Equity	-0.009** (0.004)	-0.007 (0.004)
Foreign Bond	0.002 (0.009)	0.005 (0.010)
Investment Grade	-0.009 (0.014)	-0.012 (0.015)
High Yield	0.008 (0.011)	0.009 (0.012)
Equity*Buildup		-0.077*** (0.029)
Equity*Peak		0.065** (0.029)
Bond* Buildup		-0.060 (0.042)
Bond*Peak		0.019 (0.043)
Foreign Equity*Buildup		0.023 (0.017)
Foreign Equity*Peak		-0.064*** (0.017)
Foreign Bond*Buildup		-0.012 (0.039)
Foreign Bond*Peak		-0.042 (0.039)
Investment Grade* Buildup		0.009 (0.060)
Investment Grade*Peak		0.037 (0.061)
High Yield* Buildup		-0.024 (0.048)
High Yield*Peak		0.006 (0.049)
Month FE	Yes	Yes
Observations	27,968	27,968
R^2	0.001	0.003
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 5. Impact of Crisis and Fed Response on Fund Returns

This table reports the results of an analysis of daily returns regressed on indicator variables for the covid-19 crisis and indicators for two Federal Reserve response, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). Both regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns, and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. All variables descriptions are in Appendix A.

	Returns	
	Without interaction	With interaction
	(1)	(2)
1-Period Lagged Returns	-0.181*** (0.001)	-0.184*** (0.001)
2-Period Lagged Returns	0.113*** (0.001)	0.111*** (0.001)
Daily NAV	0.009*** (0.0004)	0.010*** (0.0004)
Family Count	-0.0004*** (0.0001)	-0.0004*** (0.0001)
Management Fee	0.002*** (0.001)	0.002*** (0.001)
Expense Ratio	0.0002 (0.0002)	0.0002 (0.0002)
Turnover Ratio	0.0002 (0.001)	0.0002 (0.001)
Crisis (Feb-Mar 23, 2020)	-0.011*** (0.0001)	-0.010*** (0.0003)
First Response (Mar 23-Apr 9, 2020)	0.013*** (0.0001)	0.011*** (0.0005)
Second Response (Apr 9-May, 2020)	0.004*** (0.0001)	0.004*** (0.0003)
Equity	-0.00002 (0.0001)	-0.00001 (0.0001)
Bond	-0.0002 (0.0001)	-0.0004** (0.0002)
Foreign Equity	0.0002*** (0.0001)	0.0004*** (0.0001)
Foreign Bond	0.0001 (0.0001)	0.0002 (0.0001)
Investment Grade	-0.0001 (0.0002)	-0.0002 (0.0002)
High Yield	0.00003 (0.0001)	0.0002 (0.0002)
Equity*Crisis		-0.002*** (0.0003)
Equity*First Response		0.004*** (0.001)
Equity*Second Response		0.0001 (0.0003)
Bond*Crisis		0.007*** (0.0005)
Bond*First Response		-0.006*** (0.001)
Bond*Second Response		-0.002*** (0.0005)
Foreign Equity*Crisis		-0.0005** (0.0002)
Foreign Equity*First Response		-0.003*** (0.0003)
Foreign Equity*Second Response		-0.0005** (0.0002)
Foreign Bond*Crisis		-0.002*** (0.0005)
Foreign Bond*First Response		0.001** (0.001)
Foreign Bond*Second Response		0.001 (0.0005)
Investment Grade*Crisis		0.002*** (0.001)
Investment Grade*First Response		-0.003** (0.001)
Investment Grade*Second Response		-0.0003 (0.001)
High Yield*Crisis		-0.003*** (0.001)
High Yield*First Response		0.003*** (0.001)
High Yield*Second Response		0.0003 (0.001)
Month FE	Yes	Yes
Observations	835,541	835,541
R^2	0.079	0.081
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 6. Impact of the Evolution of Crisis on Fund Returns

This table reports the results of an analysis of daily returns regressed on indicator variables for different stages of the covid-19 crisis, without (1) and with interactions (2) among those indicators and different ETF types (Equity, Bond, Foreign Equity, Foreign Bond, High Yield, and Investment Grade). Both regressions include controls for the key fund characteristics (fund family count, expense ratio, and turn ratio), returns and lagged returns, and nav. The time period is January 2019 – September 2020. All specifications include controls for a month. Clustered Standard Errors are reported in parenthesis. All variables descriptions are in Appendix A.

	Returns	
	Without interaction	With interaction
	(1)	(2)
1-Period Lagged Returns	-0.164*** (0.001)	-0.167*** (0.001)
2-Period Lagged Returns	0.125*** (0.001)	0.123*** (0.001)
Daily NAV	0.009*** (0.0004)	0.009*** (0.0004)
Family Count	-0.0004*** (0.0001)	-0.0004*** (0.0001)
Management Fee	0.002*** (0.001)	0.002*** (0.001)
Expense Ratio	0.0001 (0.0002)	0.0001 (0.0002)
Turnover Ratio	0.0002 (0.001)	0.0002 (0.001)
Buildup (Feb, 2020)	-0.004*** (0.0001)	-0.004*** (0.0004)
Outbreak (Mar 1-13, 2020)	-0.011*** (0.0002)	-0.011*** (0.001)
Peak (Mar 13-Apr, 2020)	0.002*** (0.0001)	0.001*** (0.0003)
Equity	-0.00000 (0.0001)	0.00002 (0.0001)
Bond	-0.0002 (0.0001)	-0.0004*** (0.0001)
Foreign Equity	0.0002*** (0.0001)	0.0003*** (0.0001)
Foreign Bond	0.0001 (0.0001)	0.0002 (0.0001)
Investment Grade	-0.0001 (0.0002)	-0.0002 (0.0002)
High Yield	0.00003 (0.0002)	0.0002 (0.0002)
Equity*Buildup		-0.001*** (0.0004)
Equity*Outbreak		-0.001 (0.001)
Equity*Peak		0.001* (0.0003)
Bond* Buildup		0.004*** (0.001)
Bond*Outbreak		0.010*** (0.001)
Bond*Peak		-0.002*** (0.001)
Foreign Equity*Buildup		-0.00001 (0.0003)
Foreign Equity*Outbreak		-0.004*** (0.0004)
Foreign Equity*Peak		-0.0003 (0.0002)
Foreign Bond*Buildup		-0.001* (0.001)
Foreign Bond*Outbreak		-0.002*** (0.001)
Foreign Bond*Peak		0.0001 (0.0005)
Investment Grade* Buildup		0.001 (0.001)
Investment Grade*Outbreak		0.003** (0.001)
Investment Grade*Peak		-0.0001 (0.001)
High Yield* Buildup		-0.001 (0.001)
High Yield*Outbreak		-0.004*** (0.001)
High Yield*Peak		-0.001 (0.001)
Month FE	Yes	Yes
Observations	835,541	835,541
R^2	0.061	0.062
Note:		*p<0.1; **p<0.05; ***p<0.01

Figures

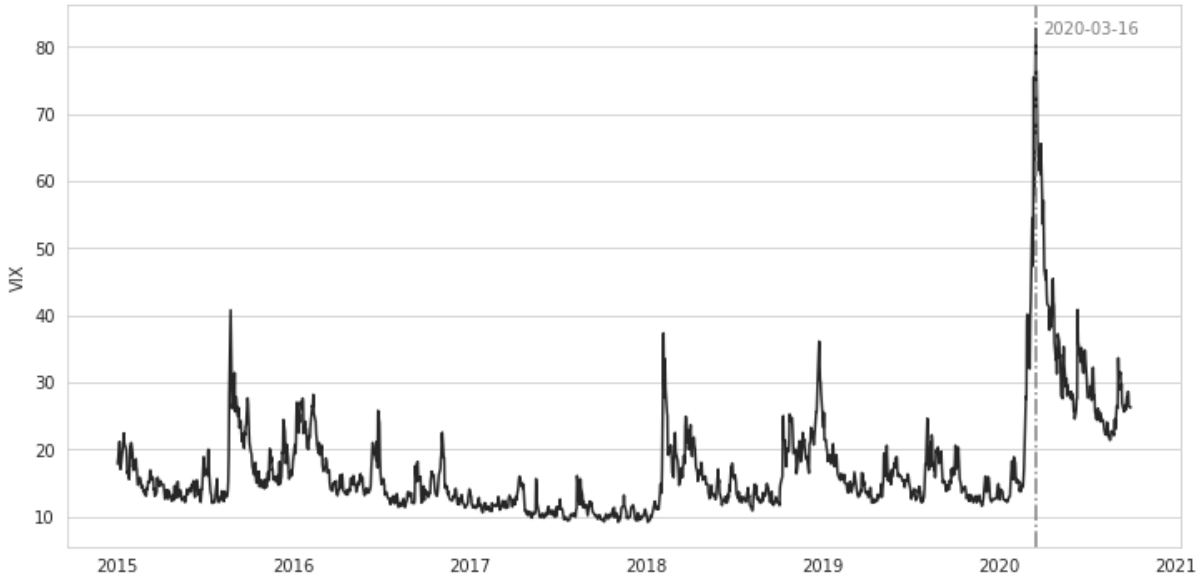

Figure 1. CBOE Volatility Index Time Series

This figure plots a time-series of daily VIX closing prices. The time period is September 2019 to September 2020. It is a proprietary elaboration based VIX closing data from the Yahoo Finance database.

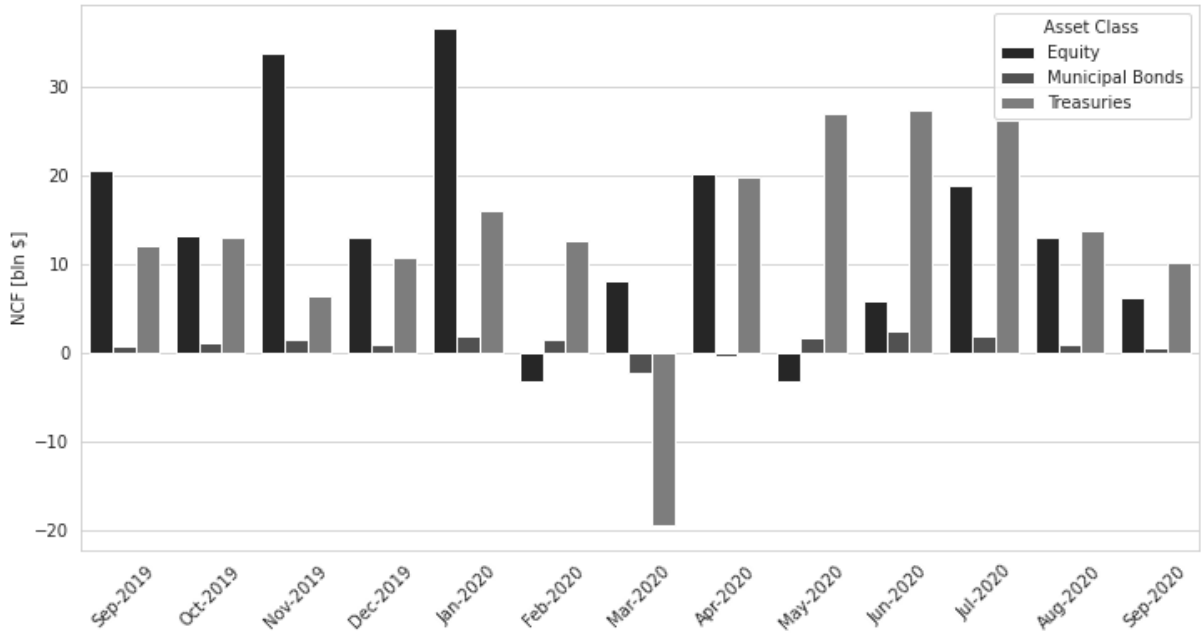

Figure 2. Aggregated Net Cash Flows for ETFs by Asset Class

This figure plots a monthly evolution of aggregated net cash flows for ETFs by three asset classes: Equity, Municipal Bonds, and Treasury. The time period is September 2019 to September 2020. It is a proprietary elaboration based on the monthly time-series and fund characteristics data from the CRSP Fund Mutual database.

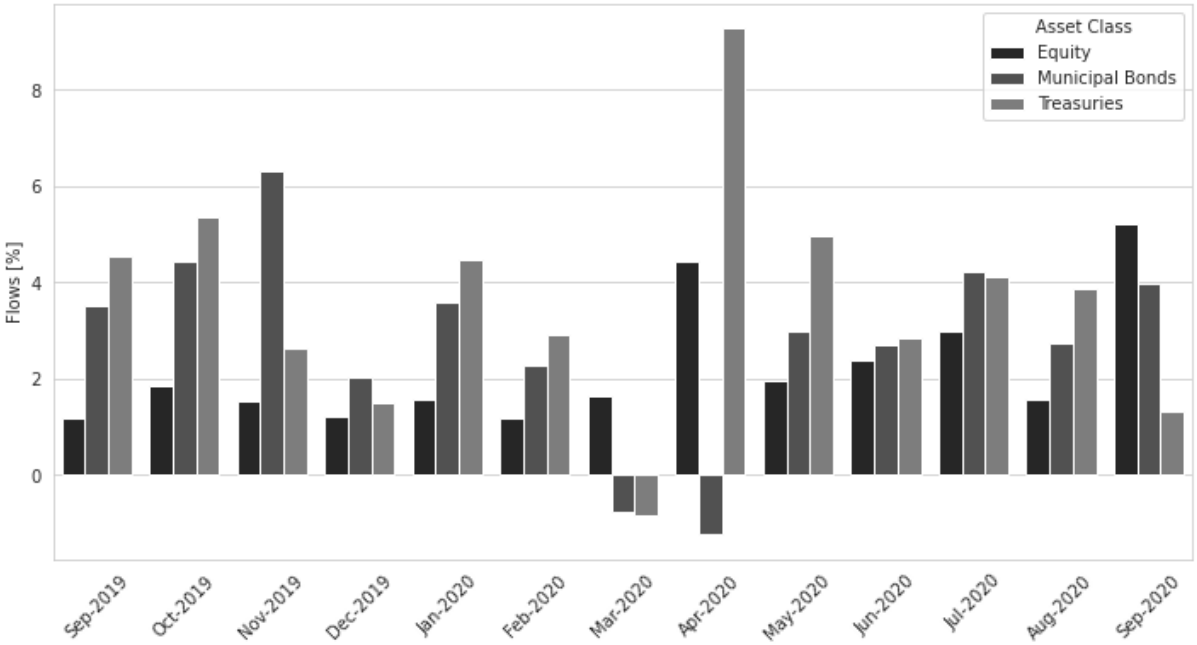

Figure 3. Average Flows for ETFs by Asset Class

This figure plots a monthly evolution of average flows for ETFs of three asset classes: Equity, Municipal Bonds, and Treasury. The time period is September 2019 to September 2020. It is a proprietary elaboration based on the estimation of flows from the monthly time-series and fund characteristics data from the CRSP Fund Mutual database. Flow averages do not include funds that were created after Q3 2018.

Figure 4. Weighted Cumulative Returns for ETFs by Asset Class

This figure plots the daily time-series of weighted cumulative returns for ETFs of three asset classes: Equity, Municipal Bonds, and Treasury. The time period is September 2019 to September 2020. It is a proprietary elaboration based on the daily time-series and fund characteristics data from the CRSP Fund Mutual database. The cumulative returns were calculated since September 2019. For simplicity, the weights were calculated using the Total Net Asset Value of each fund at the end of Q3 2019.

Figure 5. Average Net Asset Value for ETFs by Asset Class

This table represents daily time-series of average net asset value for ETFs of three different asset classes: Equity, Municipal Bonds, and Treasuries. The time period is September 2019 to September 2020. It is a proprietary elaboration based on the daily time-series and fund characteristics data from the CRSP Fund Mutual database.

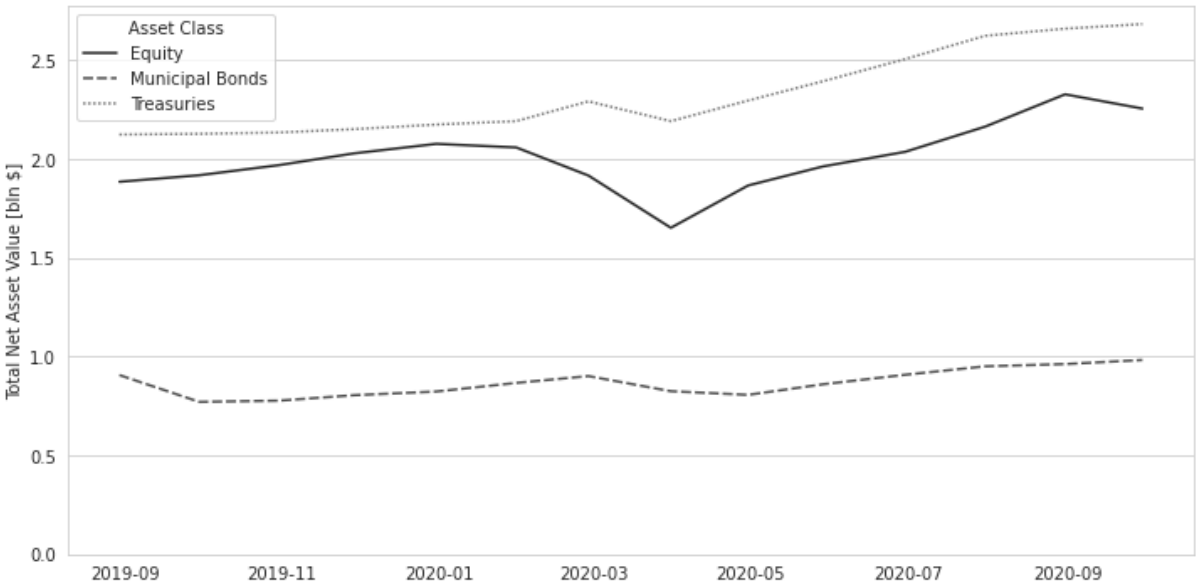

Figure 6. Average Monthly Total Net Asset Value for ETFs by Asset Class

This table represents monthly time-series of average total net asset value for ETFs of three different asset classes: Equity, Municipal Bonds, Treasuries. The time period is September 2019 to September 2020. It is a proprietary elaboration based on the monthly time-series and fund characteristics data from the CRSP Fund Mutual database.

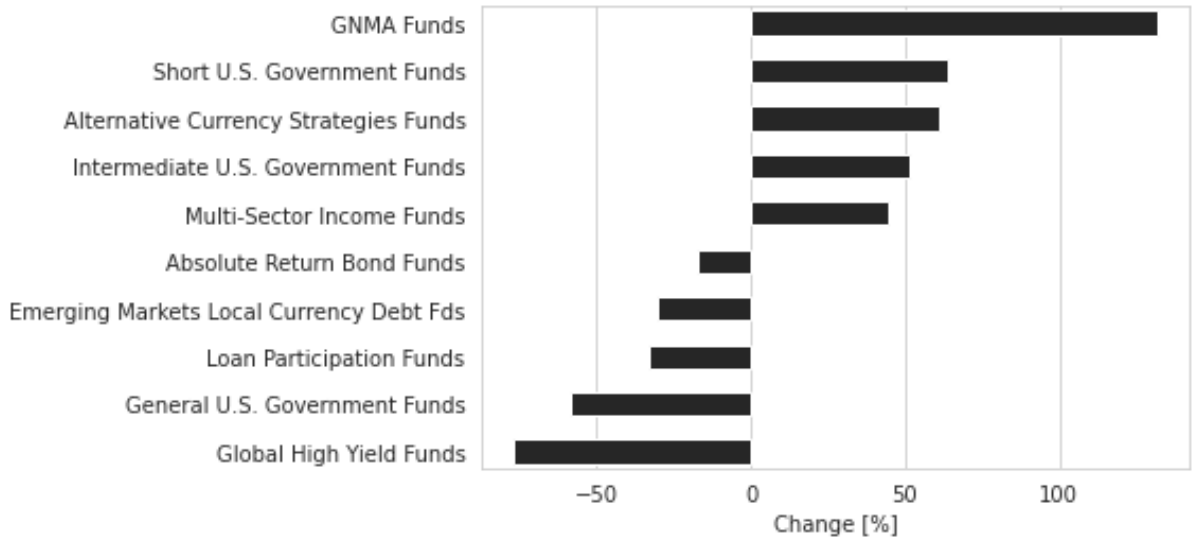

Figure 7. AUM Top Movers for Treasury ETF by Lipper Asset Class in Q1 2020

This table represents change during Q1 2020 of aggregated treasury ETFs' total net assets by Lipper Asset Class classification of funds for the top five and bottom five movers, the most significant change. It is a proprietary elaboration based on quarterly fund characteristics data from the CRSP Fund Mutual database.

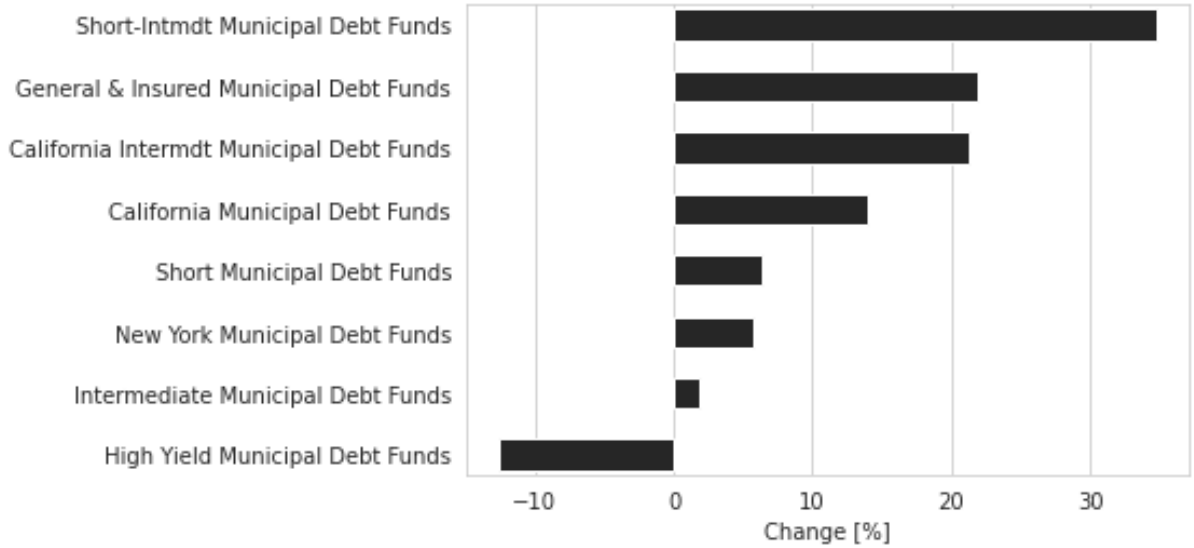

Figure 8. AUM Top Movers for Municipal Bonds ETF by Lipper Asset Class in Q1 2020

This table represents change during Q1 2020 of aggregated municipal bonds ETFs' total net assets by Lipper Asset Class classification of funds for the top five and bottom five movers, the most significant change. It is a proprietary elaboration based on quarterly fund characteristics data from the CRSP Fund Mutual database.

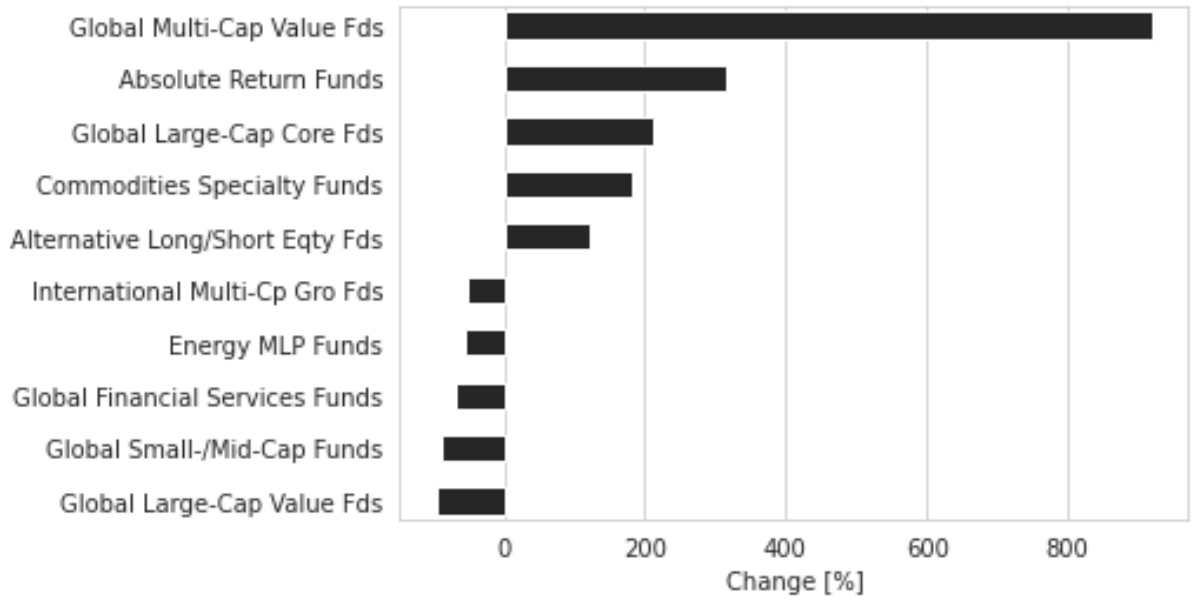

Figure 9. AUM Top Movers for Equity ETF by Lipper Asset Class in Q1 2020

This table represents change during Q1 2020 of aggregated equity ETFs' total net assets by Lipper Asset Class classification of funds for the top five and bottom five movers, the most significant change. It is a proprietary elaboration based on quarterly fund characteristics data from the CRSP Fund Mutual database.